

SEAN D. BIRKEL

Climate Change Institute & School of Earth and Climate Sciences
 135 Sawyer Environmental Research Center
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PROFESSIONAL APPOINTMENTS

- 2015 – present** **Maine State Climatologist**
2015 – present **Research Assistant Professor**, Climate Change Institute & School of Earth and Climate Sciences, University of Maine
2013 – 2014 **Research Assistant Professor**, Climate Change Institute, University of Maine

EDUCATION AND PROFESSIONAL EXPERIENCE

- 2010 – 2012** **Postdoctoral Research Fellow**, Climate Change Institute, University of Maine, Orono, ME.
 Mentors: Kirk A. Maasch and Paul Mayewski.
2010 **Ph.D.** in Earth Sciences, Department of Earth Sciences, University of Maine, Orono, ME.
 Dissertation: *Climate Investigations Using Ice Sheet and Mass Balance Models with Emphasis on Northern Hemisphere Glaciation*. Committee Chair: Peter O. Koons.
2004 **M.Sc.** in Quaternary Geology and Climate Change, Climate Change Institute, University of Maine, Orono, ME. Thesis: *Is Meltwater Pulse 1A Real and Could It have Originated in the Northern Hemisphere in Response to Bolling Warming?* Primary Advisor: George H. Denton.
2002 **B.Sc.** in Geological Sciences, Department of Earth Sciences, University of Maine, Orono, ME.
 Capstone: *Examination of Late Pleistocene Shorelines on the Pineo Ridge Glaciomarine Delta*.
 Co-Advisors: George H. Denton, Harold W. Borns.

PUBLICATIONS (Peer-Reviewed)**In Revision or Submitted**

1. Simonson, J.M., **Birkel, S.D.**, Maasch, K.A., Mayewski, P.A., Lyon, B., Carleton, A. WRF Simulation, PBL Sensitivity, and Analysis of the December 2013 New England Ice Storm. AMS Weather and Forecasting (in revision).
2. Elias, S.P., Maasch, K.A., **Birkel, S.D.**, Anderson, N.T., Gardiner, A.M., Rand, P.W., Lacombe, E.H., Robich, R.M., Lubelczyk, Smith, R.P. Jr. Blacklegged tick phenology in northern versus southern Maine, USA (submitted to Journal of Medical Entomology).

Published

1. Rodda, C., Mayewski, P.A., **Birkel, S.D.** A 2000 year-long proxy and observational reconstruction of Central Asian climate. Quaternary Science Reviews (in press).
2. Auger, J.D., Mayewski, P.A., Maasch, K.A., Schuenemann, K.C., Carleton, A.M., **Birkel, S.D.**, Saros, J.E. 2000 Years of North Atlantic-Arctic Climate. Quaternary Science Reviews, 216, p. 1-17, <https://doi.org/10.1016/j.quascirev.2019.05.020>.
3. Auger, J.D., **Birkel, S.D.**, Maasch, K.A., Mayewski, P.A., Schuenemann, K.C., 2018. An ensemble mean and evaluation of third generation global reanalysis models. MDPI Atmosphere, 9, 236, doi:10.3390/atmos9060236.
4. **Birkel, S.D.**, Mayewski, P.A., Maasch, K.A., Kurbatov, A.V., Lyon, B., 2018. A volcanic underpinning of the Atlantic Multidecadal Oscillation. NPJ Climate and Atmospheric Science, 1, Article 24, doi:10.1038/s41612-018-0036-6.

5. Graeter, K.A., Osterberg, E.C., Ferris, D.G., Hawley, R.L., Marshall, H.P., Lewis, G., Meehan, T., McCarthy, F., **Birkel, S.D.**, 2018. Ice Core Records of West Greenland Melt and Climate Forcing. *Geophysical Research Letters*, 45 (7), p. 3164-3172, doi:10.1002/2017GL076641.
6. Winski, D.A., Osterberg, E.C., Kreutz, K.J., Wake, C.P., Ferris, D., Campbell, S., Baum, M., Bailey, A., **Birkel, S.D.**, Introne, D., Handley, M.J., 2018. A 400-year ice core melt layer record of summertime warming in the Alaska Range. *Journal of Geophysical Research Atmospheres*, 123 (7), p. 3594-3611, doi:10.1002/2017JD027539.
7. Auger, J.D., **Birkel, S.D.**, Maasch, K.A., Mayewski, P.A., Schuenemann, 2017. Examination of precipitation variability in southern Greenland. *Journal of Geophysical Research Atmospheres*, 122, 6202–6216, doi:10.1002/2016JD026377.
8. Mayewski, P.A., Carleton, A.M., **Birkel, S.D.**, Dixon, D., Kurbatov, A.V., Korotkikh, E., McConnell, J., Curran, M., Cole-Dai, J., Jiang, S., Plummer, C., Vance, T., Maasch, K.A., Sneed, S.B., Handley, M., 2017. Ice core and climate reanalysis analogs to predict Antarctic and Southern Hemisphere climate changes. *Quaternary Science Reviews*, 155, p. 50-66, doi:10.1016/j.quascirev.2016.11.017.
9. Osterberg, E.C., Winski, D.A., Kreutz, K.J., Wake, C.P., Ferris, D.G., Campbell, S., Introne, D., Handley, M., **Birkel, S.D.**, 2017. The 1200 year composite ice core record of Aleutian Low intensification. *Geophysical Research Letters*, 44(14), p. 7447-7454, doi:10.1002/2017GL073697.
10. Dieffenbacher-Krall, A.C., Borns, H.W., Nurse, A.M., Langley, G.E.C., **Birkel, S.D.**, Cwynar, L.C., Doner, L.A., Dorion, C.C., Fastook, J.L., Jacobson, G.L. Jr., 2016. Younger Dryas paleoenvironments and ice dynamics in northern Maine: a multi-proxy, case history. *Northeastern Naturalist*, 23(1), p. 67-87, doi:/10.1656/045.023.0105.
11. Putnam, A.E., Putnam, D.E., Andreu-Hayles, L., Cook, E.R., Palmer, J.D., Clark, E.H., Wang, C., Chen, F., Denton, G.H., Boyle, D.P., Bassett, S.D., **Birkel, S.D.**, Martin-Fernandez, J., Hajdas, I., Southon, J., Garner, C.B., Cheng, H., Broecker, W.S., 2016. Little Ice Age wetting of interior Asian deserts and the rise of the Mongol Empire. *Quaternary Science Reviews*, 131(A), p. 33-50, doi:10.1016/j.quascirev.2015.10.033.
12. Strock, K.E., Saros, J.E., Nelson, S.J., **Birkel, S.D.**, Kahl, J.S., McDowell, W.H., 2016. Extreme weather years drive episodic changes in lake chemistry: implications for recovery from sulfate deposition and long-term trends in dissolved organic carbon. *Biogeochemistry*, 127, p. 353-365, doi:10.1007/s10533-016-0185-9.
13. Grigholm, B., Mayewski, P.A., Kang, S., Zhang, Y., Morgenstern, U., Schwikowski, M., Kaspari, S., Aizen, V., Aizen, E., Takeuchi, N., Maasch, K.A., **Birkel, S.D.**, Handley, M., Sneed, S., 2015. 20th Century dust lows and the weakening of the westerly winds over the Tibetan Plateau. *Geophysical Research Letters*, 42, p. 1-8, doi:10.1002/2015GL063217.
14. Mayewski, P.A., Bracegirdle, T., Goodwin, I., Schneider, D., Bertler, N.A.N., **Birkel, S.D.**, Carleton, A., England, M.H., Kang, J-H., Khan, A., Russell, J., Turner, J., Veliconga, I., 2015. Potential for Southern Hemisphere climate surprises. *Journal of Quaternary Science*, 30(5), p. 391-395.
15. Saros, J.E., Osburn, C.L., Northington, R.M., **Birkel, S.D.**, Auger, J.D., Stedmon, C.A., Anderson, N.J., 2015. Recent decrease in DOC concentrations in Arctic lakes of southwest Greenland. *Geophysical Research Letters*, 42(16), p. 6703-6709.
16. Schaefer, J.M., Putnam, A.E., Denton, G.H., Kaplan, M.R., **Birkel, S.D.**, Doughty, A.M., Kelley, S., Barrell, D.J., Finkel, R.C., Winckler, G., Anderson, R.F., Ninneman, U.S., Barker, S., Schwartz, R., Andersen, B.G., Schluechter, C., 2015. The Southern Glacial Maximum 65,000 years ago and its Unfinished Termination. *Quaternary Science Reviews*, 114, p. 52-60, doi:10.1016/j.quascirev.2015.02.009.
17. Bromley, G.R., Putnam, A.E., Rademaker, K.M., Lowell, T.V., Schaefer, J.M., Hall, B., Winckler, G., **Birkel, S.D.**, Borns, H.W., 2014. Younger Dryas deglaciation of Scotland driven by warming summers. *Proceedings of the National Academy of Sciences*, 111(17), p. 6215-9, doi: 10.1073/pnas.1321122111.
18. Mayewski, P.A., Sneed, S.B., **Birkel, S.D.**, Kurbatov, A.V. and Maasch, K.A., 2014. Holocene warming marked by abrupt onset of longer summers and reduced storm frequency around Greenland. *Journal of Quaternary Science*, 29(1), p. 99-104, DOI: 10.1002/jqs.2684.

19. Koffman, B.G., Kreutz, K.J., Breton, D.J., Kane, E.J., Winski, D.A., **Birkel, S.D.**, Kurbatov, A.V., Handley, M.J., 2013. Centennial-scale shifts in the position of the Southern Hemisphere westerly wind belt over the past millennium. *Climate of the Past Discussions*, 01/2013; 9:3125-3174. doi:10.5194/cpd-9-3125-2013.
20. Putnam, A.E., Schaefer, J.M., Denton, G.H., Barrell, D.J., **Birkel, S.D.**, Andersen, B.G., Kaplan, M.R., Finkel, R.C., Schwartz, R., Doughty, A.M., 2013. The last local glacial maximum at 44°S documented by a ¹⁰Be moraine chronology at Lake Ohau, Southern Alps of New Zealand. *Journal of Quaternary Science Reviews*, 62, p. 114-141, doi:10.1016/j.quascirev.2012.10.034.
21. **Birkel, S.D.**, Putnam, A.E., Denton, Koons, P.O., Fastook, J.L., Putnam, D.E., Maasch, K.A., 2012. Climate inferences from a glaciological reconstruction of the Late Pleistocene Wind River Ice Cap, Wind River Range, Wyoming. *Arctic, Antarctic, and Alpine Research*, 44(3), p. 265-276.

REPORTS AND OTHER PUBLICATIONS (Not Peer-Reviewed)

1. Jones, H.M., Mecray, E., **Birkel, S.D.**, Conlon, K., Kinney, P., Silva, V.B.S., Solecki, W., Surgeon-Rigers, T.M., 2019. Understanding Decision Context to Improve Heat Health Information. *Bulletin of the American Meteorological Society*, doi:10.1175/BAMS-D-19-0042.1.
2. **Birkel, S.D.**, Mayewski, P.A., 2018. *Coastal Maine Climate Futures*. Orono, ME: Climate Change Institute, University of Maine. 24pp.
3. **Birkel, S.D.**, Mayewski, P.A., 2015. Analysis of historical and projected future climate of Mali, West African Sahel. Project Report. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at www.ccafs.cgiar.org.
4. Fernandez, I.J., Schmitt, C.V., **Birkel, S.D.**, Stancioff, E., Pershing, A.J., Kelley, J.T., Runge, J.A., Jacobson, G.L., Mayewski, P.A., 2015. *Maine's Climate Future: 2015 Update*. Orono, ME: University of Maine. 24pp.

CONFERENCE ABSTRACTS

1. Elias, S., **Birkel, S.D.**, Anderson, N., Lubelczyk, C., Smith, R., Maasch, K., 2018. Deer Tick Phenology and Warming Climate in Maine, USA. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, April.
2. **Birkel, S.D.**, Mayewski, P.A., Maasch, K.A., 2017. Changes in Atmospheric Circulation from Volcanic Aerosol Forcing as Key Driver of North Atlantic Sea-Surface Temperature Variability. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, April.
3. Lewis, G., Osterberg, E.C., Hawley, R.L., Koffman, B.G., Marshall, H.P. **Birkel, S.D.**, Dibb, J.E., 2016. Albedo Spatial Variability and Causes on the Western Greenland Ice Sheet Percolation Zone. AGU Fall Meeting, San Francisco, CA.
4. **Birkel, S.D.**, Osterberg, E.C., Kreutz, K.J., Wake, C.P., Campbell, S., Winski, D.A., 2015. Reanalysis context for ice cores recovered from Mt. Hunter, Denali National Park, USA. Abstract PP33A-2272, AGU Fall Meeting, San Francisco, CA, 16 Dec.
5. Auger, J., **Birkel, S.D.**, Maasch, K.A., Mayewski, P.A., 2014. Effects of Extratropical cyclone frequency and intensity on mass balance of the Greenland Ice Sheet. Abstract GC21C-0560, AGU Fall Meeting, San Francisco, CA, 15-19 Dec.
6. Beers, T.M., Mayewski, P.A., Kern, S., Kurbatov, A., **Birkel, S.D.**, 2014. A Ross Sea Polynya Proxy Produced From the RICE Ice Core Record, Roosevelt Island, Antarctica. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 17-18 April.
7. **Birkel, S.D.**, Mayewski, P.A., Maasch, K.A., Koons, P.O., 2014. Pressing forward with Climate Reanalyzer. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 17-18 April.
8. Kreutz, K., Campbell, S., **Birkel, S.D.**, Osterberg, E.C., Winski, D., Wake, C., 2014. Hydroclimate variability in the northeast Pacific over the past millennium. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 17-18 April.

9. Strock, K.E., Saros, J.E., Nelson, S.J., **Birkel, S.D.**, 2014. Interactive effects of extreme weather and reduced sulfate deposition: accelerated recovery from acidification and increased brownification in lakes of the Northeast U.S. Association for the Sciences of Limnology & Oceanography, Portland, OR, 18-23 May.
10. **Birkel, S.D.**, Mayewski, P.A., Maasch, K.A., Koons, P.O., 2013. The Climate Reanalyzer. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 22-23 April.
11. Kelly, M.A., Osterberg, E.C., Axford, Y., Bigl, M., **Birkel, S.D.**, Corbett, L.B., Roy, E.P., Thompson, J.T., Whitecloud, S., 2013. Evidence for smaller extents of the northwestern Greenland Ice Sheet and North Ice Cap during the Holocene. Abstract C33A-0663, AGU Fall Meeting, San Francisco, CA, 9-13 Dec.
12. Koffman, B.G., Kreutz, K.J., Breton, D.J., Kane, E.J., Winski, D.A., **Birkel, S.D.**, Kurbatov, A.V., Handley, M.J., 2013. Centennial-scale shifts in the position of the Southern Hemisphere westerly wind belt over the past millennium. Abstract PP31D-1892, AGU Fall Meeting, San Francisco, CA, 9-13 Dec.
13. Strock, K.E., Saros, J.E., **Birkel, S.D.**, Nelson, S.J., 2013. Exploring the effects of extreme hydrologic events in the northeastern U.S.: Implications for brownification and episodic acidification in Maine Lakes. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 5-6 April.
14. Wheeler, L., Koons, P.O., Upton, P., **Birkel, S.D.**, 2013. Modeling the influence of the Last Glacial Maximum ice load on the tectonics of southeast Alaska. Abstract T23D-2621, AGU Fall Meeting, San Francisco, CA, 9-13 Dec.
15. **Birkel, S.D.**, Maasch, K.A., Mayewski, P.A., 2012. A web-based utility for visualizing and interrogating climate reanalysis products. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 5-6 April.
16. **Birkel, S.D.**, Maasch, K.A., Oglesby, R.J., Fulginiti, L.E., Trindade, F., Hays, C., 2012. Changes in water and wind resources across the central and northeastern U.S. 2060-2010 in 24 km WRF downscale climate simulations. Abstract A41H-0065, AGU Fall Meeting, San Francisco, CA, Dec.
17. Burakowski, E.A., Chen, M., **Birkel, S.D.**, Wake, C.P., Dibb, J.E., 2012. Climate Impacts Mid-1800's Deforestation in New England using the Weather, Research, and Forecasting Model. Abstract A32E-07, AGU Fall Meeting, San Francisco, CA, Dec.
18. Maasch, K.A., Yang, Y., **Birkel, S.D.**, Sensitivity of a regional weather model to the choice of domain size, location, and spatial resolution. Harold W. Borns, Jr. Symposium, University of Maine, Orono, Maine, 5-6 April.
19. Rowe, C.M., Oglesby, R.J., Hays, C., Mawalagedara, R., Maasch, K.A., **Birkel, S.D.**, Ganguly, A.R., 2012. Effects of Very High (4-12 km) Resolution on the Simulation of Surface Temperature and Precipitation in Regions of Complex Topography and Heterogeneous Land Use. Abstract A31L-08, AGU Fall Meeting, San Francisco, CA, Dec.
20. **Birkel, S.D.**, Maasch, K.A., Oglesby, R.J., Rowe, C., Hays, C., 2011. A downscaled multi-domain WRF model climate forecast for the northeastern and central U.S. for 2050-2054. Abstract GC21B-0891, AGU Fall Meeting, San Francisco, CA, Dec.
21. **Birkel, S.D.**, Koons, P.O., Pingree, K.A., Segee, B.E., Zhu, Y., Schauffler, M., 2009. Simple climate model and web interface for inquiry-based learning at Middle and High School grade levels. Abstract ED33A-0551, AGU Fall Meeting, San Francisco, CA, Dec.
22. Putnam, A.E., Denton, G.H., Schaefer, J.M., Putnam, D.E., **Birkel, S.D.**, Quesada, P., Kaplan, M.R., Schwartz, R., Finkel, R.C., Evenson, E.B., Andersen, B., Barrell, D., Doughty, A., Broecker, W.S., 2009. Timing and duration of the Last Glacial Maximum and Termination in the western United States and Southern Alps, New Zealand. Abstract PP24A-06, AGU Fall Meeting, San Francisco, CA, Dec.
23. **Birkel, S.D.**, Koons, P.O., Fastook, J.L., 2008. Climatic implications of the mechanical collapse of the Laurentide Ice Sheet. Abstract C21D-07, AGU Fall Meeting, Dec.

OUTREACH (Invited Presentations)

- 8/2019** The Center for Moosehead History, Greenville, ME
- 8/2019** Penobscot Maritime Museum, Searsport, ME
- 7/2019** Seven Lakes Alliance, Belgrade Lakes, ME
- 6/2019** Climate and Environment Panel, Blue Hill Public Library, Blue Hill, ME (**Panel**)
- 3/2019** Aroostook County Soil and Water Conservation District, Houlton, ME
- 2/2019** School of Biology and Ecology Seminar Series, University of Maine, Orono, ME
- 1/2019** Northeast Aquaculture Conference & Exposition, Boston, MA (**Keynote**)
- 12/2018** Piscataquis County Soil and Water Conservation District, Greenville, ME
- 6/2018** Maine National Guard, University of Maine, Orono, ME (**Panel**)
- 6/2018** Penobscot Shores Retirement Community, Belfast, ME
- 3/2018** Maine Science Festival, Bangor, ME
- 10/2017** Wabanaki Climate Conference, University of Maine, Orono, ME
- 1/2017** Maine Agricultural Trades Show, Augusta, ME
- 11/2016** Wabanaki Climate Adaptation Workshop, Calais, ME
- 7/2016** Jonathan Fisher Memorial, Blue Hill Public Library, Blue Hill, ME
- 4/2016** Friends of Baxter State Park Annual Meeting, Augusta, ME
- 10/2015** Baxter State Park Annual Staff Meeting, Millinocket, ME
- 9/2015** Hancock County Democrats Meeting, Ellsworth, ME
- 7/2015** Orgonon Nature Program, Rangeley, ME
- 5/2015** Seminar on Climate Change, College of the Atlantic, Bar Harbor, ME
- 4/2015** Maine Emergency Management Agency, Augusta Civic Center, Augusta, ME
- 4/2015** Center for an Ecology Based Economy, The Commons, Norway, ME

SCHOLARLY PRESENTATIONS

- 6/2019** *Data Visualization using Climate Reanalyzer*
Annual Meeting of the American Association of State Climatologists, Santa Rosa, CA
- 4/2018** *Climate Change in Maine*
Maine Climate and Agriculture Network, University of Maine, Orono, ME
- 12/2017** *Maine's Climate*
Gulf of Maine Research Institute, Portland, ME (**Invited**)
- 5/2017** *Heat Waves in Maine*
Maine DHHS Heat Response Planning Workshop, Augusta, ME
- 4/2017** *How to Access NOAA Weather Forecast Data for Use in Agriculture Decision Models*
USDA Northeast Climate Hub Webinar
- 11/2016** *Volcanoes, the Westerlies, and North Atlantic Sea-Surface Temperatures*
School of Earth and Climate Sciences, University of Maine, Orono, ME
- 9/2015** *Maine's Climate: Past, Present, and Future*
Climate and Agriculture Symposium, University of Maine, Orono, ME
- 5/2015** *Maine's Climate: Past, Present, and Future*
Maine Climate Change Adaptation Conference for the Casco Bay Region, U.S. Dept. of

- Homeland Security, University of Southern Maine, Portland, ME
- 11/2014** *Maine's Changing Climate*
Affinity Luncheon, University of Maine, Orono, ME (**Invited**)
- 10/2014** *Software Tools for Assessing Vulnerability, Adaptation and Sustainability*
CLAS conference, Climate Change Institute, University of Maine, Orono, ME
- 10/2014** *Challenges in Reconstructing Past Climate and Hydrology of Tarim Basin*
Comer Climate Conference, Soldiers Grove, WI
- 11/2013** *Climate Reanalyzer*
Sustain Mid-Maine Coalition, Kennebec Valley Community College, Fairfield, ME
- 10/2013** *Paleo Glacier and Climate Reconstruction in the Western U.S.*
Comer Climate Conference, Soldiers Grove, WI
- 4/2013** *Perspectives on Maine's Climate*
Student Forum, University of Maine at Farmington, Farmington, ME (**Invited**)
- 9/2012** *Numerical Reconstruction of Paleo Ice Sheets*
Comer Climate Conference, Soldiers Grove, WI
- 3/2012** *Climate Change in Maine*
University of Maine at Farmington, Farmington, ME (**Invited**)
- 3/2012** *High-Resolution Simulations of Climate Change using WRF*
University of Nebraska at Lincoln, Lincoln, NE
- 11/2011** *Using a Mesoscale Model to Predict Future Climate in the Northeastern U.S.*
Maine Center for Disease Control, Augusta, ME
- 4/2011** *High Resolution Climate Downscaling using WRF*
Harold W. Borns Jr. Symposium, Climate Change Institute, University of Maine, ME
- 3/2010** *The Laurentide Ice Sheet: Climate Driver or Passenger?*
Department of Earth Sciences, Dartmouth College, Hanover, NH
- 5/2009** *The Role of the Laurentide Ice Sheet in Driver Glacial Cycles*
Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA
- 5/2009** *A glaciological reconstruction of the Wind River Ice Cap, Wind River Range, Wyoming*
Department of Earth Sciences, University of Maine, Orono, ME
- 12/2008** *Implications for the Origin of Ice Ages from Laurentide Ice Sheet Modeling*
AGU Fall Meeting, San Francisco, CA
- 9/2008** *Climatic Implications of the Mechanical Collapse of the Laurentide Ice Sheet*
Department of Atmospheric Sciences Colloquium, Colorado State University, Fort Collins, CO (**Invited**)
- 9/2008** *Climatic Implications of the Mechanical Collapse of the Laurentide Ice Sheet*
Climate and Global Dynamics Seminar, National Center for Atmospheric Research, Boulder, CO (**Invited**)

TEACHING EXPERIENCE

University of Maine

Spring 2018

Climate Analysis

In this graduate-level course, students used NCAR Command Language (NCL) to interrogate scientific datasets. Emphasis was placed on large gridded datasets in netCDF and GRIB formats. Semester projects pertained directly to student theses. In addition to learning how to construct NCL scripts, students learned the

- fundamentals of UNIX/Linux computing environments, and also how to construct a website for presenting course material. (Enrollment: 9)
- Spring 2013** **Climate and Earth System Data Analysis and Visualization**
In this graduate-level course, students used NCAR Command Language (NCL) to interrogate scientific datasets. Emphasis was placed on large gridded datasets in netCDF and GRIB formats. Semester projects pertained directly to student theses. In addition to learning how to construct NCL scripts, students learned the fundamentals of UNIX/Linux computing environments, and also how to construct a website for presenting course material. (Enrollment: ~10)
- Spring 2010** **Introduction to MATLAB Programming**
This advanced undergraduate course provided an overview of how to use the MATLAB scripting environment to process and visualize scientific datasets. Course projects were assigned based on student scientific interest areas. (Enrollment: 5)
- Spring, Fall 2007** **Introductory Geology Laboratory (Teaching Assistant)**
Taught 3-4 sections of the 100-level undergraduate laboratory. (Class Size: 15-25)
- Spring 2006** **Environmental Geology of Maine Laboratory (Teaching Assistant)**
Taught 3-4 sections of the 100-level undergraduate laboratory. (Class Size: 15-25)
- Fall 2004 –
Fall 2005** **Jordan Planetarium (Teaching Assistant)**
Gave regular lectures to school groups K-12; taught 3-4 sections of General Astronomy Laboratory twice each semester. (Class Size: 10-45)

STUDENT ADVISING

| Name | Degree | Supervision Dates | Institution | Role |
|------------------|------------------|-------------------|-------------|------------------|
| Julia Simonson | PhD | 9/2016 – present | UMaine | Committee Chair |
| Jeffrey Auger | PhD | 1/2017 – 5/2019 | UMaine | Committee Member |
| Charles Rodda | PhD | 7/2017 – present | UMaine | Committee Member |
| Ali AlJoda | PhD | 3/2018 – present | UMaine | Committee Member |
| Hunter Tubbs | MS | 4/2019 – present | UMaine | Committee Member |
| Adrienne Lovuolo | MS | 3/2018 – present | UMaine | Committee Member |
| Kimberly Miner | PhD | 9/2015 – 5/2018 | UMaine | Committee Member |
| Jeffrey Auger | MS | 9/2014 – 12/2016 | UMaine | Advisor |
| Thomas Beers | MS | 9/2013 – 12/2014 | UMaine | Committee Member |
| Matthew Koehler | BS Honors Thesis | 9/2012 – 5/2013 | UMaine | Committee Member |
| Jennifer McCabe | PhD | 9/2013 – 12/2015 | UMaine | Committee Member |
| Lauren Wheeler | MS | 9/2012 – 12/2013 | UMaine | Committee Member |
| Yi Yang | MS | 9/2011 – 12/2014 | UMaine | Committee Member |

FIELD RESEARCH AND TRAINING

- 9/2013** Field mapping and boulder sample collection from moraines for cosmogenic exposure-age dating, Mono Lake region, Sierra Nevada, California. University of Maine.
- 7/2009** Field mapping and boulder sample collection from moraines for cosmogenic exposure-age dating, Upper South Fork Basin, Wind River Range, Wyoming. University of Maine.
- 7/2008** Field mapping and boulder sample collection from moraines for cosmogenic exposure-age dating, New Fork Lakes, Wind River Range, Wyoming. University of Maine.
- 7/2006** Co-taught undergraduate geology field camp at the Deboullie Ecological Preserve in northern Maine. University of Maine at Presque Isle.
- 8/2003** Glacial geology and field methods and mapping in Iceland (course for graduate credit). University of Cincinnati.

- 1-2/2003** Sediment coring for lake-level change study, McMurdo Dry Valleys, Antarctica. University of Maine.
- 5-6/2001** Geology field methods and mapping sites in Wyoming, Colorado, Utah, and New Mexico (course for undergraduate credit). University of Wyoming.

ONLINE DATA PRODUCTS

- Developer of CCI's ClimateReanalyzer.org – *Climate Reanalyzer* is a visualization and data-access platform for climate models, station data, and global and regional weather forecasts. The website is operated across four servers, including a virtual machine and data storage provided by the UMaine Advanced Computing Group (ACG). *Climate Reanalyzer* utilizes several terrabytes of state-of-the-art reanalysis and gridded data at monthly and daily timescales. The model data are sourced primarily from distribution systems operated by NOAA, the National Center for Environmental Information (NCEI), and the European Centre for Medium-Range Forecasts (ECMWF). *Climate Reanalyzer* generates weather maps continuously throughout the day from raw model output downloaded from NOAA. The website includes over a dozen user-friendly interfaces for research, education, and general access. *Climate Reanalyzer* has global viewership and sees ~2500 users daily. The most visited page is Today's Weather, which displays global maps of the current day's temperature, wind, precipitation, cloud cover, sea ice, and other meteorological conditions. Images from *Climate Reanalyzer* have been posted in online news articles (including from Washington Post, CNN, Huffington Post, Sydney Morning Herald), and on popular weather and climate blogs (including Weather Underground and Discover Magazine) in relation to extreme weather and climate events.
- Co-developer (with Paul Mayewski) of CCI's ClimateFutures.net – *Climate Futures* is a CCI initiative that utilizes plausible scenario planning for future climate adaptation, mitigation, and sustainability at local, regional, and global scales. The *Climate Futures* website provides an interactive framework and roadmap for how to use CCI's *Climate Reanalyzer* to empower users to construct their own plausible scenario plans.
- Co-developer (with Paul Mayewski, Erik Albert, Sudarshan Chawathe, Andrei Kurbatov, Mark Royer, Bjorn Grigholm, and Willie Stevenson) of CCI's 10Green.org – *10Green* is a website that enables users to compare and rank the healthiness of U.S. towns and cities based on EPA air quality data.
- Developer of CCI's [Maine Climate Office](http://MaineClimateOffice.org) – This website is the online presence of the *Maine Climate Office* run by Birkel as the State Climatologist. The website provides access to Maine climate and weather data for school groups and the general public.
- Co-Developer of *AgEye Weather* – This project is part of a collaboration with Glen Koehler in Cooperative Extension to provide custom weather forecasts and gridded observational data to growers and agriculture researchers. *AgEye Weather* currently serves over 70 customers via e-mail, fax, and online datafiles. The service is currently free as it remains underdevelopment, but will become fee-based in January, 2020 through the UMaine Department of Industrial Cooperation.

SYNERGISTIC ACTIVITIES

- *Maine State Climatologist* – Since 2015, I have served as the Maine State Climatologist. State climatologists are appointed by a state entity (in this case, the University of Maine) and approved and recognized by the Director of the National Centers of Environmental Information (NCEI) of the National Oceanic and Atmospheric Administration (NOAA). State climatologists provide expertise on climate and weather to stakeholders and the general public. More specifically, we provide climate services – the production and translation of climate information to facilitate climate decision-making, policy, and planning. To accomplish these objectives, I work in collaboration with partners in

NOAA, the National Weather Service (NWS), and the American Association of State Climatologists (AASC). I also work in this capacity with faculty within the UMaine community, such as those affiliated with the Maine Climate and Agriculture Network (ME-CAN) (see below), to disseminate climate information to stakeholders. Moreover, I give media interviews and public presentations on climate and weather throughout the year. I am also a NOAA Weather-Ready Nation Ambassador, where I offer my services to help NOAA partners strengthen resilience against extreme weather. Depending on stakeholder needs and the available budget, some state climatologists maintain a state climate office with one or more staff members. I presently maintain the Maine Climate Office at the Climate Change Institute with assistance from Ph.D. student Julia Simonson. The Maine Climate Office is well positioned for future expansion, given the increasing need for climate services in our state, particularly in relation to agriculture and other natural resource-based economic sectors.

- Member of the [*Maine Climate and Agriculture Network \(ME-CAN\)*](#), an initiative to increase communication and coordination within the UMaine community among those working on issues related to climate and agriculture. ME-CAN includes faculty and graduate students affiliated with Cooperative Extension, School of Food and Agriculture, School of Forest Resources, School of Biology and Ecology, School of Earth and Climate Sciences, the Climate Change Institute, and Maine Sea Grant.
- Served as a faculty mentor (summer 2019) for the NSF Research Experience for Undergraduates (REU) Accelerating New Environmental Workskills (ANEW) project awarded to colleagues Anne Lichtenwalner and Kristina Cammen in affiliation with the UMaine Initiative for One Health and the Environment. The REU ANEW mentee undertook a project evaluating the linkages between warm winters following the 1997/98 El Niño and the rise in Lyme disease cases in Maine. This work was done in collaboration with broader impacts mentor Susan Elias (Climate Change Institute and the Maine Medical Center Research Institute).
- Co-led an NSF Arctic Data Workshop at UMaine in May 2019 with CCI colleagues Andrei Kurbatov (lead) and Shudarshan Chawathe. The workshop brought together faculty and graduate students in the Arctic ice core community to foster communication, and to develop strategies for improving research workflows related to paleoclimate data storage and reconstruction.
- Produced the report [*Coastal Maine Climate Futures*](#) with co-author Paul Mayewski from support provided by the Russell Grinnell Memorial Trust. This report explores climate-commodity connections, and outlines five plausible scenarios for future climate across coastal Maine.
- Served on a steering committee to assist NOAA in developing Heat Health Decision Calendars via the National Integrated Heat Health Information System (NIHHIS). The project culminated in a stakeholder workshop in Westborough, MA in October 2018.
- Served on advisory panel for the future development of the NCAR Command Language (NCL) and related Python scripting packages (summer 2018). NCL is a widely-used scripting language for producing maps and analyses of gridded climate and weather data products.
- Participant in a strategic planning meeting of the NOAA Northeast Drought Early Warning Information System, National Integrated Drought Information System (NIDIS) (December 2017).
- Co-authored [*Maine's Climate Future 2015 Update*](#) (Climate Change Institute and Maine Sea Grant) with colleagues Ivan Fernandez (lead), Catherine Schmitt, Esperanza Stancioff, Andrew Pershing, Joseph Kelley, Jeffrey Runge, George Jacobson, and Paul Mayewski. This document is a follow-up to the original Maine's Climate Future report (2009) developed to inform stakeholders about climate and environmental changes in Maine.

COLLABORATORS (Last 5 Years)**UMaine**Lily Calderwood (*SFA/CE*)Kristina Cammen (*SMS*)Sudarshan Chawathe (*CCI/SCIF*)Sandra De Urioste-Stone (*SFR*)James Fastook (*CCI/SCIS*)Ivan Fernandez (*CCI/SFR*)Allison Gardner (*SBE*)Bjorn Grigholm (*CCI/SECS*)George Jacobson (*CCI/SBE*)Joseph Kelley (*CCI/SECS*)Glen Koehler (*CE*)Peter Koons (*CCI/SECS*)Karl Kreutz (*CCI/SECS*)Andrei Kurbatov (*CCI/SECS*)Shawn Laatsch (*PA*)Danielle Levesque (*CCI/SBE*)Anne Lichtenwalner (*SFA/CE*)Bradfield Lyon (*CCI/SECS*)Kirk Maasch (*CCI/SECS*)Paul Mayewski (*CCI/SECS*)Aaron Putnam (*CCI/SECS*)Erin Roche (*CE*)Jasmine Saros (*CCI/SBE*)Bruce Segee (*ECE/SCIS*)Molly Schauffler (*CCI/SECS/RiSE*)Esperanza Stancioff (*CE/MSG*)Giles Timms (*Dept. of Art*)Terry Yoo (*SCIS*)Dominic Winski (*CCI/SECS*)Michael Wittmann (*PA/RiSE*)*CE=Cooperative Extension**CCI=Climate Change Institute**ECE=Department of Electrical and Computer Engineering**MSG=Maine Sea Grant**RiSE=Maine Center for Research in STEM Education**SBE=School of Biology and Ecology**SCIS=School of Computing and Information Science**SECS=School of Earth and Climate Sciences**SFA=School of Food and Agriculture**SFR=School of Forest Resources**SMS=School of Marine Sciences**PA=Department of Physics and Astronomy***External**Jeffrey Auger (*Universidade Federal do Rio Grande do Sul*)Scott Bassett (*University of Nevada, Reno*)Douglas Boyle (*University of Nevada, Reno*)Gordon Bromley (*National University of Ireland, Galway*)Andrew Carleton (*Pennsylvania State University*)Susan Elias (*Maine Medical Center Research Institute*)Robert Hawley (*Dartmouth College*)Hunter Jones (*UCAR/NOAA*)Michael Kaplan (*Lamont-Doherty Earth Observatory*)Meredith Kelly (*Dartmouth College*)Hans-Peter Marshall (*Boise State University*)Ellen Mecray (*NOAA/NCEI*)Erich Osterberg (*Dartmouth College*)Baker Perry (*Appalachian State University*)David Putnam (*University of Maine at Presque Isle*)Joerg Schaefer (*Lamont-Doherty Earth Observatory*)

Anton Seimon (*Appalachian State University*)
 Keah Schuenemann (*Metropolitan State University of Denver*)
 Kristin Strock (*Dickinson College*)
 Cameron Wake (*University of New Hampshire*)

PROFESSIONAL MEMBERSHIPS

- American Association of State Climatologists

FUNDING

Proposals In Preparation

- 1) NSF AISL (\$1,133,373; UMaine PI Birkel, Co-PIs Laatsch, Timms, Yoo, Wittmann), **Down to Earth: Climate and Weather Learning for Planetarians**. *Activities*: This proposal aims to provide immersive short-course workshops and to produce state-of-the-art data visualizations for planetarium operators that will facilitate communication and learning in climate and weather science. The proposal involves UMaine faculty with backgrounds spanning climate, astronomy, physics, STEM education, art, and computer science. My role includes overall project coordination, software development, and graduate student advising.

Active Grants

- 1) UMaine Senator George J. Mitchell Center for Sustainability Solutions (\$30,000; UMaine PI Calderwood, Co-PIs Koehler, Birkel, Roche), **Connecting UMaine and Maine Farmers through Weather Decision-Making Tools**. *Activities*: This project aims to identify, develop, and document Maine farmer needs and priorities regarding weather information, services, and farm management decision support tools. My role is to participate in stakeholder meetings and to continue the development of decision support tools related to the Maine Climate Office and AgEye Weather.
- 2) UMaine Research Reinvestment Fund (RRF) Student Awards Competition (\$30,000; UMaine PI Gardner, Co-PIs De Urioste-Stone, Birkel, Levesque), **Biophysical and Social Dimensions of Tick-borne Disease Risk in Maine's Public Parks and Natural Areas**. *Activities*: Providing project team members with assistance in obtaining climate data, and will supervise an undergraduate student in the production of a Lyme disease awareness document that will be distributed in print and online via the Maine Climate Office.
- 3) NSF P2C2-1600018 (\$798,539; UMaine PI Mayewski, Co-PI Birkel), **Collaborative Research: Ultra-High-Resolution Investigation of High Andean Snow and Ice Chemistry To Improve Paleoclimatic Reconstruction and Enhance Climate Prediction**. *Activities*: Using reanalysis and dynamically downscaled meteorological fields to develop modern circulation analogs to past Andean climate inferred from ice cores.

Recently Completed Grants

- 1) Russell Grinnell Memorial Trust (\$50,000; UMaine PI Mayewski, Co-PI Birkel) [*completed 8/2019*], **Interactive Climate Futures Framework for the U.S.** *Activities*: In this second grant from the Russell Grinnell Memorial Trust, we developed an framework for creating future climate plausible scenario plans by utilizing the data visualization capabilities of CCI's Climate Reanalyzer. As part of this project, additional climate datasets were acquired, and new timeseries and map interfaces were added to Climate Reanalyzer.
- 2) NSF EarthCube (\$49,999; UMaine PI Kurbatov, Co-PIs Chawathe, Birkel) [*completed 8/2019*], **NSF Summer 2019 Workshop: Computing Arctic Data**. *Activities*: The workshop brought together researchers in the Arctic ice core community to foster communication, and to develop strategies for improving research workflows related to paleoclimate data storage and reconstruction. I co-led the workshop and presented a session on reanalysis data visualization.

- 3) UMaine Senator George J. Mitchell Center for Sustainability Solutions (\$40,705; UMaine PI De Urioste-Stone, Co-PIs Gardner, Levesque, Birkel) [completed 6/2019], **Mitigating Socioecological Determinants of Tick-borne Disease Risk in Acadia National Park**. *Activities:* In this project I 1) developing maps of probable historical blacklegged tick habitat across Maine based on summer degree-day accumulation, 2) provided climate and weather data to project members, and 3) worked with PhD. student Susan Elias to develop a deer-tick awareness document for public distribution (*Deer Ticks: Linkages to Climate, Deer, and Invasive Planets in Maine*).
- 4) Russell Grinnell Memorial Trust (\$50,000; UMaine PI Mayewski, Co-PI Birkel) [completed 8/2018], **A Pilot Study to Guide Maine's People and Commerce in a Changing Climate**. *Activities:* Developing plausible climate scenarios for coastal Maine with emphasis on changes in extreme weather and possible economic impacts over the next 30 years. This project led to the production of the report *Coastal Maine Climate Futures*.
- 5) NSF PLR-1417640 (\$169,567; UMaine PI Birkel; Dartmouth [lead] PI Osterberg, Co-PI Hawley; Boise PI Marshall) [completed 3/2018], **Collaborative Research: GreenTrACS: a Greenland Traverse for Accumulation and Climate Studies**. *Activities:* Investigating changes in snow accumulation across west Greenland over the past three decades using reanalysis models; 2) determining the benefit of downscaling reanalysis for this problem domain using the Weather Research and Forecasting (WRF) model. This grant provided 2 years tuition and stipend support for M.Sc. student Jeffrey Auger. This project produced three published manuscripts.